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[54] **ELEMENT REMOVAL TOOL FOR SYSTEM CARRYING FLUID UNDER PRESSURE**

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[51] **Int. Cl.**[4] **B23P 19/04**

[52] **U.S. Cl.** ..... **29/213 R**

[58] **Field of Search** ..... 29/213 R, 213 E, 240; 137/317, 318, 319

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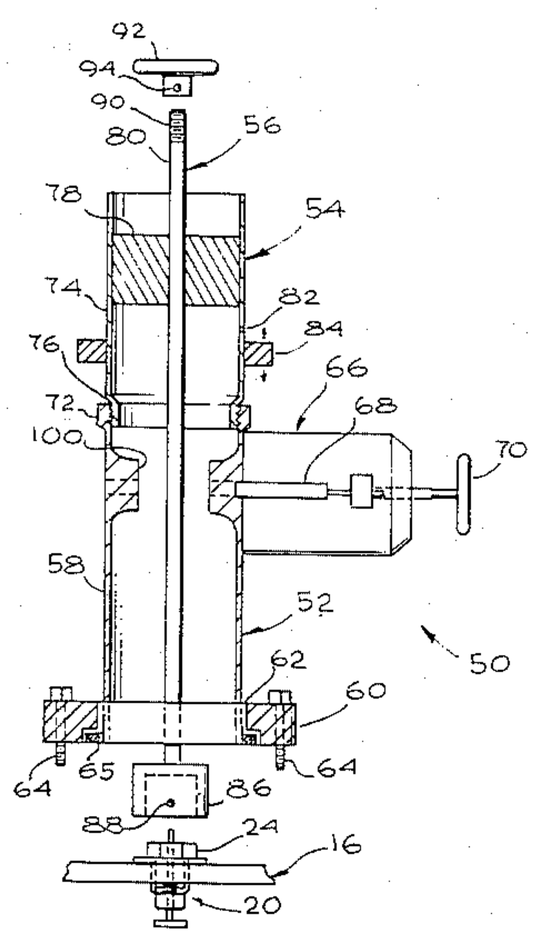
[57] **ABSTRACT**

A tool is provided which permits the removal and replacement of a defective axle box in a flow meter or volume-pressure corrector ("system member") without disturbing downstream consumers of the fluid (e.g., gas), under pressure, passing through the system, such tool having an orientable flange for connecting directly to the flat upper surface of the member, such flange being supported on a second end of a first pipe, the first end of which is threaded to receive a second pipe having therein gas impervious stuffing with a coaxial hole therethrough to receive, with a hermetic seal, the shaft of an element-removal portion of the tool, such shaft having a socket affixed to one end thereof and a handle removable attached to the other end, such second pipe having a threaded end for connecting to said first pipe and a selectively operable bleed-hole located in its wall between said threaded end and said stuffing to permit safe and controlled release of gas from said second pipe after the socket of said removal tool has been withdrawn to a point on the stuffing side of a gate valve in the first pipe, when the first and second pipes are connected, the removable handle on said shaft making it possible to engage an axle box with the socket on the shaft and then slide the shaft through the hole in the stuffing and assemble the overall tool in position with the flange bolted to the flat surface of the member, to provide a tool with maximum safety and efficiency but with minimum complexity.

5 Claims, 2 Drawing Figures



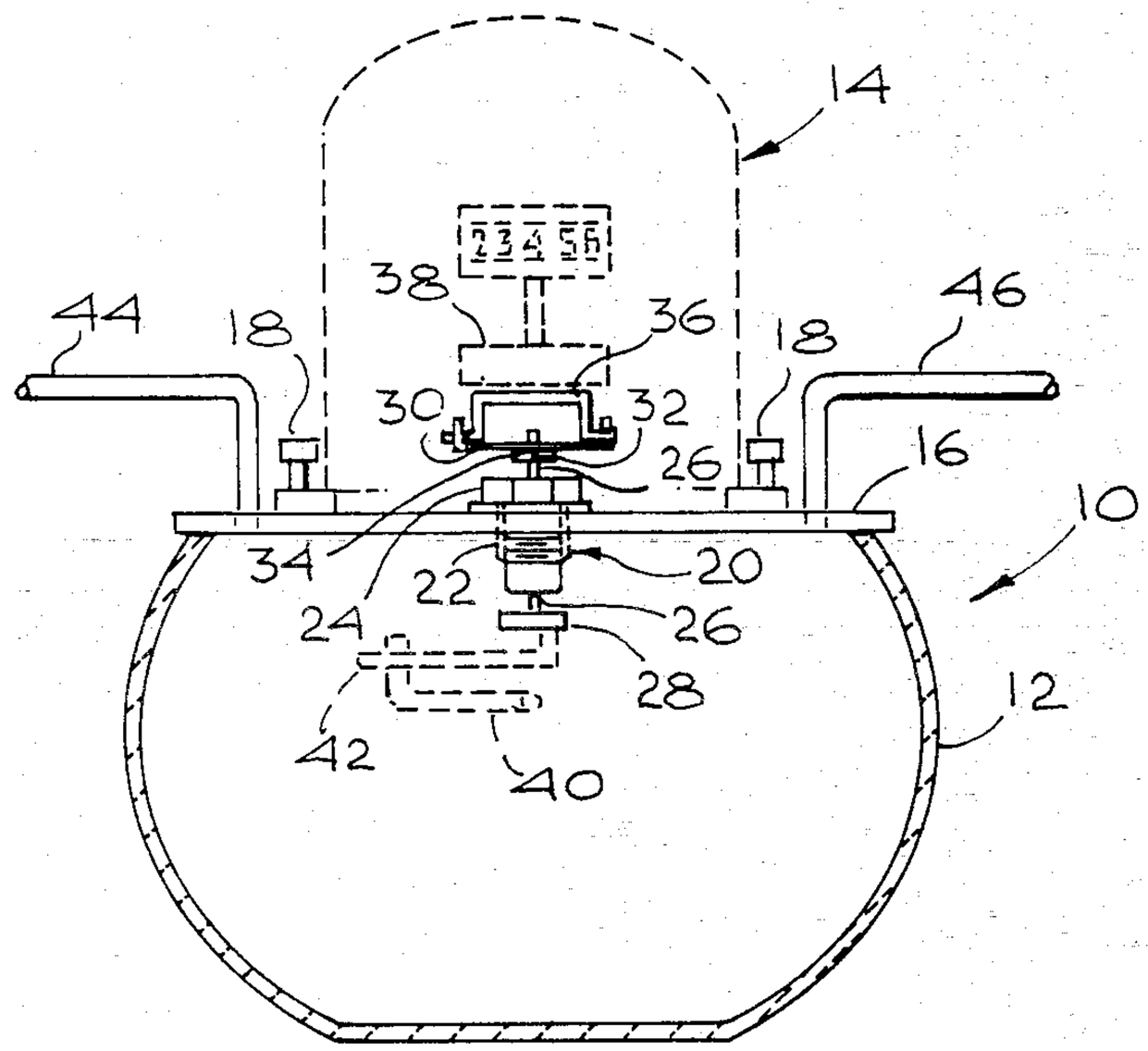

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Fig. 1

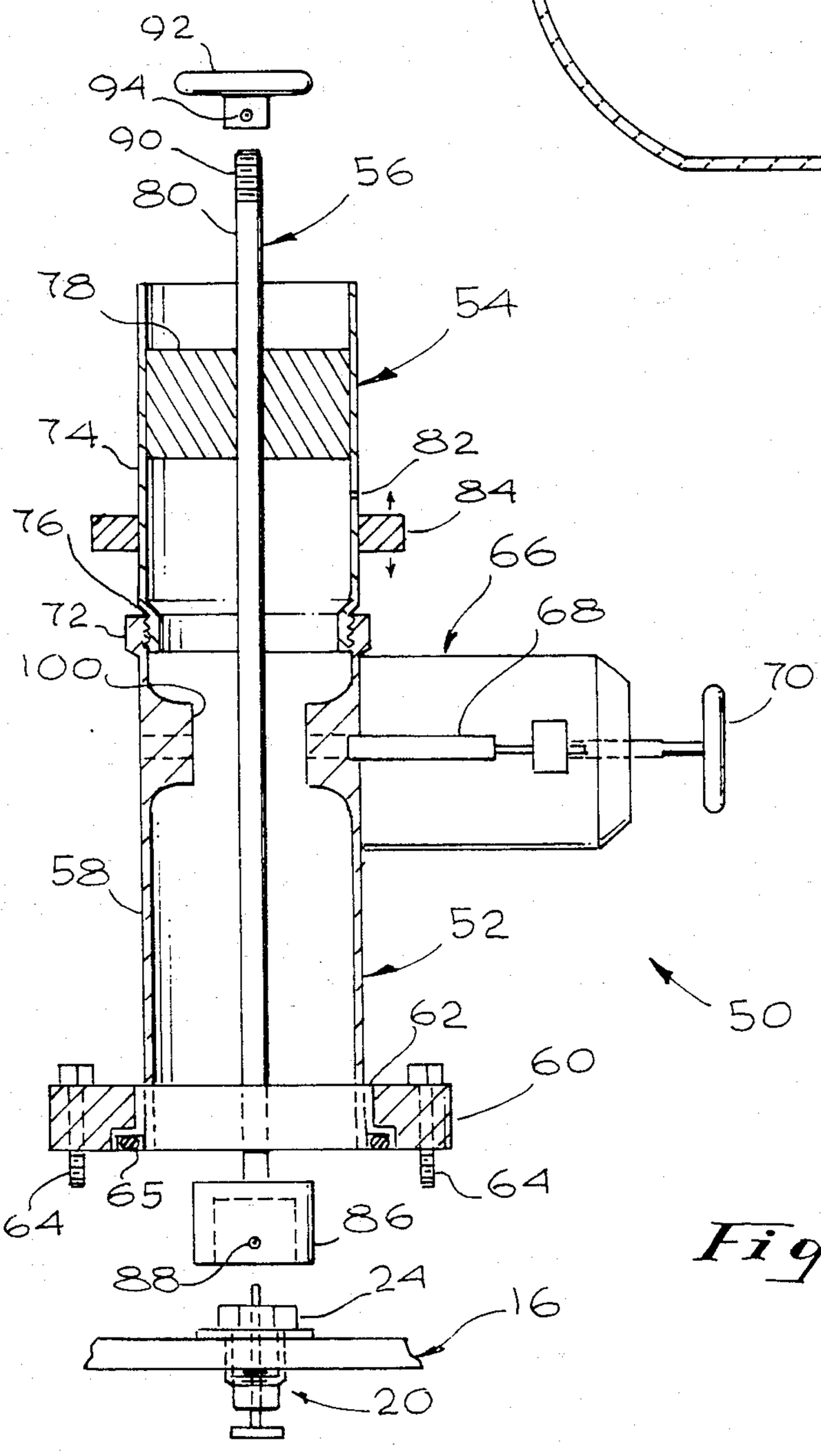
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Fig. 2

ELEMENT REMOVAL TOOL FOR SYSTEM CARRYING FLUID UNDER PRESSURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the field of tools and more particularly to the field of specialized tools for maintaining transmission lines carrying volatile fluids under pressure.

2. Prior Art

In the transmission of highly volatile liquids, such as gasoline, or in the transmission of natural gas, it is necessary to meter the flow of the gas from the source to the user. It is also often necessary to connect other elements, such as pressure-correctors, to the line for proper control and measurement of the gas flow.

Particularly in the transmission of natural gas, the index of the flow of gas is maintained in ambient air conditions but the flow information comes from a flow sensor which, at one end, is active and maintained in the environment of the fluid which is passing through the transmission lines. At the other end the sensor is coupled into the indexing or metering elements or, in some cases, into the pressure and flow rate correction mechanism. The flow sensor normally used involves a vane which is activated by the flow of gas through a metering chamber. The vane rotates at a rate related to the rate of flow of the fluid being measured. At the opposite end of the sensing device, and in an ambient air environment, there is a coupling unit, sometimes called a "wiggler" which is mechanically coupled into the pressure correcting or indexing mechanism. There is a rotary seal about the shaft which couples the two ends of the sensing element. This sensing element, in the natural gas transmission field, is referred to as an "axle box". With time, because of the rotary motion of the shaft in the axle box, the seal wears and leaking of gas through the seal occurs. This, of course, is not tolerable for two reasons. First, it is highly dangerous to permit the leakage of natural gas into any region, particularly into a basement where such metering devices are normally found. The explosive power of natural gas is well known. Second, the accuracy of the correction or of the gas flow measurement is reduced as leakage increases. For both these reasons, from time-to-time it is necessary in a gas transmission line to replace the axle boxes which are associated with the gas meters or volume-pressure correctors.

In the past, in order to replace the axle box assembly it has been necessary to completely by-pass the meter, a process which can take from one to three hours. It also requires several people to achieve the by-passing result. There also is a degree of danger involved in the complete by-pass procedure. In addition to the safety factor, the cost of the labor utilized in by-passing the meter and replacing the axle box by that process is unnecessarily and undesirably excessive.

It is further object of this invention to provide a tool assembly which will permit easy replacement of the flow sensing element in a transmission line for fluids under pressure.

SUMMARY OF THE INVENTION

A tool assembly is provided which comprises three major elements:

First, a base sealing element which can be secured to the metering chamber over the sensing element or axle box after the indexing or volume correcting portion of the meter has been removed from the metering chamber;

Second, a shaft element carrying at one end a socket which is sized and shaped to correspond to the upper flange portion of the sensing element or axle box so as to firmly engage that upper flange portion of the axle box for rotation of the axle box in its insertion and removal; and,

Third, a stuffing box which can fit over the shaft and can be joined to the base sealing unit in hermetically sealed fashion.

The base sealing unit includes a gate valve which is effective to cut off the escape to the atmosphere of any gas or other fluid under pressure from the transmission line when the axle box has been removed from its place inserted in the wall of the metering chamber. For example, this occurs when the shaft carrying the socket at its lower end has extracted the axle box from the metering chamber and the shaft has been withdrawn so that the socket portion carrying the axle box is in the stuffing box portion of the tool assembly according to this invention. With the tool shaft and socket removed to that position, the stuffing box section is decoupled from the base sealing unit and the axle box is removed from the socket which is at one end of the shaft. A new axle box is secured in the socket portion at the lower end of that shaft, the stuffing box portion of the tool assembly is recoupled to the base sealing section, the gate valve in the base sealing section is then opened to permit passage of the shaft and the socket carrying the new axle box is inserted in the opening, normally threaded, in the metering chamber wall and firmly moved into place by rotary motion of the shaft carrying the socket. It is to be understood that the opening in the wall of the metering chamber is normally threaded as is the outer surface of the axle box and the top of the axle box is flanged to overlap the threaded opening in the upper wall of the metering chamber. A sealing washer is also provided between the flange at the upper end of the axle box and the upper surface of the metering chamber engaged by such flange.

When the shaft having the socket at one end is withdrawn, either after the axle box has been removed or has been replaced, the gate valve can be closed and any gasses accumulated in the stuffing box can be vented through a bleed-hole in the stuffing box, which hole, after the bleeding process has been completed, is covered by a collar which slides into position over the hole. No by-passing of the metering chamber is necessary when the tool assembly according to this invention is used.

BRIEF DESCRIPTION OF THE DRAWINGS

This invention can best be understood by reviewing the description which follows in conjunction with the drawings herein in which;

FIG. **1** is a diagrammatic representation of a metering structure in a transmission line for volatile fluids under pressure, to which my invention is applicable; and,

FIG. **2** is a diagrammatic representation of the tool assembly according to my invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. **1**, meter **10** includes a metering chamber **12** and a volume or pressure corrector, or index, **14** se-

cured to the upper wall **16** by means of threaded bolts **18**. Axle box **20** has a body portion **22** which is threaded and, an upper flange **24**, which may be hexagonal in shape for ease of securing axle box **20** in upper wall **16** of metering chamber **12**. A shaft **26** runs coaxially through body **22**. At the lower end of shaft **26** is secured a paddle-like activator portion **28**. At the upper end of shaft **26** there is a first wiggler **30** which is secured to shaft **26** by a set screw **32** and collar **34**.

Wiggler **30** is designed to engage and cooperate with a driving member **36** which is a portion of either the indexing or volume and pressure correcting mechanism included in volume and pressure corrector or indexing portion **14** of meter **10**.

In normal operation of meter **10**, paddle **28** is caused to rotate or oscillate by elements **40** and **42** contained within the metering chamber **12**. Inlet pipe **44** introduces the fluid or gas under pressure into metering chamber **12**. Outlet pipe **46** passes the fluid under pressure to the user or the next measuring point. The actual mechanism for causing paddle **28** and the shaft **26** to which it is connected to oscillate or rotate is not part of this invention and need not be described here. Shaft **26** is carried in a plastic bushing with low-friction characteristics. Such a material may be Teflon. By reason of the rotation or oscillation of shaft **26** in the bushing material within axle box **20**, the bushing material is worn and gradually leakage begins to occur around shaft **26**. Thus, some of the fluid or gas under pressure in metering chamber **20** escapes around shaft **26** and reduces the accuracy of the metering step and further raises certain dangers because of the normal volatility of the gas or other fluid being transmitted through pipes **44**, **46**. Thus, it is necessary, from time-to-time, to replace axle box **20**. In the past, to achieve that end it was necessary to by-pass meter **10** with a rather elaborate network of pipes and fixtures. The process was time consuming and potentially dangerous.

Turning to FIG. **2**, there is shown a tool assembly which avoids the by-passing operation previously required when an axle box began leaking. In that figure, tool assembly **50** includes a base sealing unit **52**, a stuffing box unit **54** and an axle box removal unit **56**.

Base sealing unit **52** includes a tube portion **58**, and a sealing flange portion **60** rotatably coupled to the lower end **62** of tube **58**. The ability of flange **60** to rotate is necessary in order to assure that the attachment screws **64** will align with the corresponding receiving openings in the upper wall **16** of metering chamber **12** in FIG. **1**.

Towards the upper end of base sealing unit **52** there is a gate-valve assembly **66** comprising a gate-valve element **68** adjustable in its position internally to cylinder **58** by means of knob **70** which, upon rotation, causes valve element **68** to move into the space within tube **58** to block off the flow of fluids through tube **58**. The construction of the gate-valve mechanism is well known and need not be explained here. The upper end **72** of tube **58** is internally threaded to receive stuffing box **54**.

Stuffing box **54** includes tube **74** having threads **76** at the lower end thereof, cooperating with the internal threads in upper portion **72** of base sealing unit **52**. Unit **54** also includes stuffing material **78** which is impervious to the gas or other fluid in the transmission system being maintained. However, it does have a central opening therethrough for the passage of the shaft portion **80** of axle box removal unit **56**. Stuffing or packing material **78** fits snugly about shaft **80** as it passes through packing material **78**. Stuffing box unit **54** includes, in addition, a bleeding-hole **82** for bleeding off gas or other fluid when gate-valve **66** is closed. When gate-valve **66** is open, collar **84** is slid over bleeding-hole **82** to prevent the escape to the atmosphere of the gas or other fluid being transmitted in the associated transmission system.

Axle box removal unit **56** includes shaft **80** at one end of which is socket **86** having internal dimensions designed to cooperate with flange **24** of axle box **20**. Socket **86** also includes a set screw **88** which may be of the Allen-head variety. It is to be understood that socket **86** is in a fixed position on one end of shaft **80**. At the other end of shaft **80** there may be a threaded portion **90** for receiving a handle **92** having a set screw **94** therein. This handle is useful in manually rotating axle box removal unit **56**. The handle is screwed on to threaded portion **90** when insertion or removal of an axle box is to occur and after the rest of the tool assembly is in position for operation.

The steps involved in utilizing tool assembly **50** are as follows. First, remove index box or pressure corrector assembly **14** by loosening studs **18**. Wiggler **30** of axle box **20** easily decouples from driving element **36** of the index box assembly **14**. Next, remove wiggler **30** from shaft **26** by loosening set screw **32**. Now slightly loosen the axle box assembly so as to break the seal at the juncture of flange **24** with upper wall **16** of metering chamber **12**. The purpose of this step is to make easier the use of the axle box removal unit **56**.

Next with axle box removal unit **56** removed from the rest of the tool assembly **50** (after removing handle **92** from upper and threaded end **90** and sliding shaft **26** out through stuffing material **78** in the stuffing box unit **54**), socket **86** is applied to flange **24** of axle box unit **20** and set screw **88** is tightened to assure a good grip on flange **24**.

Base sealing unit **52** is then dropped over removal unit **56** and flange **60** is rotated until studs **64** line up with receiving threaded holes in the upper wall **16** of metering chamber **12**. Studs **64** then are tightened, which brings sealing ring **65** into firm contact with the upper surface of wall **16** and blocks any flow of gas or other fluid out through the rotating joint between flange **60** and the lower portion of tube **58** in base sealing unit **52**.

Stuffing box unit **54** is then slipped into position over shaft **80** and coupled to base sealing unit **52** rotating tube **74** so that its threads **76** cooperate with the inner threads in the upper portion **72** of base sealing unit **52**. Handle **92** may then be applied to the upper end of shaft **80** and secured in position by set screw **94**. Care must then be taken to assure that collar **84** is slid into position over bleed-hole **82**. At this point the tool assembly is hermetically sealed and in position over and in cooperative relation with axle box **20**. Handle **92** is then rotated in the appropriate direction, usually counter-clockwise, to remove axle box **20** from upper wall **16** of metering chamber **12**. Shaft **80** is then pulled upward until socket **86** is above the operative portion of gate-valve **66**, at which point handle **70** is turned until gate-valve **66** is closed by reason of valve element **68** spanning the space between opposing portions of the inner wall **100** of tube **58**. Stuffing box unit **54** may now be decoupled from base sealing unit **52** by rotating tube **34** in an appropriate direction to cause threaded portions **72** and **76** to disengage, at which point stuffing box unit **54** carrying axle box removal unit **56** may be taken aside and set screw **88** may be rotated to release axle box **20** from socket **86**. A

new axle box is then secured in socket **86** by means of screw **88** and the procedure is reversed.

Prior to the decoupling of stuffing box unit **54** from base sealing unit **52**, with shaft **80** retracted so that socket **86** is in the region above gate-valve **66**, with that valve closed, it is desirable to bleed down any gas which is accumulated in the stuffing box unit. This is accomplished by sliding collar **88** out of contact with bleed-hole **82** so that any gas or other fluid may escape. The quantity of that gas of course is very limited.

Returning to the new axle box insertion procedure, with the new axle box firmly gripped by socket **86** and with a sealing washer **96** crimped so that it will stay on the threaded body of axle box **20**, stuffing box unit **54** is recoupled to base sealing unit **52**, with shaft **80** still retracted. Gate-valve **70** is then opened and shaft **80**, carrying in socket **86** the new axle box, is pushed downwardly until the new axle box engages the threaded opening provided for it in the upper wall **16** of metering chamber **12**. Handle **92** may be applied to the upper end of shaft **80**, at this point, and the shaft may be rotated slowly until axle box **20** is firmly seated in the appropriate opening in the upper wall **16** of metering chamber **12**. At that point, further leakage of gas out of metering chamber **12** is cut off so the tool assembly may be bled down by sliding collar **84** off of its previous position over bleed-hole **82**, in which position it was placed prior to the opening of gate-valve **66** for the insertion of axle box **20**.

Stud **64** may then be released and the entire assembly **50** removed from the upper wall of the metering chamber **12**. Wiggler **30** is then reapplied to shaft **26** and set in position by set screw **26**.

At this point the original apparatus whether it be a standard index box assembly, a pressure corrector or any other element involved in the registration of pressure or flow and designated by numeral **14**, is returned to its original position on the upper wall **16** of metering chamber **12** and the unit is now completely ready for operation in a normal fashion.

It has been found that by using the tool assembly taught by this invention the amount of time necessary to make the change of an axle box in a live transmission line is about 15 minutes instead of the previously required time of approximately three hours. Further, a single operator may perform the change and with greater safety and less tools.

While this discussion has been primarily directed to the replacement of an axle box in a gas transmission line, the tool involved and described here is equally applicable to other transmission systems where a fluid, which is volatile, is being transmitted under pressure and there is some sensing element which invades the space where the fluid is flowing, on its one side, and is exposed to ambient air, on its other side.

While a particular embodiment of this invention has been shown and described, it will be apparent to those skilled in the art that variations and modifications may be made therein without departing from the spirit and scope of this invention. It is the purpose of the appended claims to cover all such variations and modifications.

I claim:

1. A tool for replacing an axle box in a member such as a meter, or the like, in a gas distribution system carrying gas under pressure, said member, having, a flat surface carrying said axle box, said flat surface having threaded openings proximate to the periphery thereof;

a base sealing portion including a first pipe having first and second ends, said first end carrying threads and said second end carrying a flange;

said flange on said second end of said first pipe having openings therein for passing threaded bolts therethrough, said flat surface of said member having corresponding threaded openings for receiving said bolts and securing said flange directly to said member;

a gate valve included in said base sealing portion intermediate its first and second ends for controlling the flow of gas through said first pipe;

a stuffing box portion having a second pipe with first and second ends, said first end of said second pipe carrying threads sized and pitched to cooperate with said threads carried by said first end of said first pipe;

said stuffing box portion including a bleed-hole in the wall of said second pipe;

stuffing means carried in said second pipe between said bleed-hole and said second end of said second pipe, said stuffing means having an axial opening therethrough;

closing means for selectively closing said bleed-hole; and,

an element-removal portion including a shaft, a handle removably attached to said shaft at one end and a socket coaxially affixed to said shaft at its other end, said shaft being sized to hermetically seal said axial opening in said stuffing means, said socket being sized to firmly engage said element to be removed.

2. Apparatus according to claim **1** in which said flange is free to rotate on said second end of said first pipe.

3. Apparatus according to claim **1** in which said closing means is a collar slideable on said second pipe.

4. Apparatus according to claim **1** in which said socket includes a set screw.

5. Apparatus according to claim **1** in which said second end of said first pipe is flanged and carries an O-ring for forming a hermetic seal with said member.

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